Inhibitor Longevity and Deicer Performance Study: First Year Scope of Work

(Federal Fiscal Year 2007)

1. Objectives of the Pooled Fund Study

The objectives of the proposed research are to evaluate the longevity of corrosion inhibitors in storage and on the road and their cost-effectiveness, and to establish a reliable measure to quantify the performance of anti-icing and deicing products.

Specifically, mostly through the combination of laboratory and field investigations, this Transportation Pooled-Fund study aims to answer the following important questions:

1) What is the longevity of the corrosion inhibitors, when in storage or on the road?
2) What is the duration the inhibitors remain with the deicers, when applied onto the road?
3) What are the effects of storage (temperature, UV intensity, exposure time, and type of deicer) on inhibitor longevity and effectiveness?
4) Do the inhibitors contribute to freezing point suppression or improve the effectiveness of deicers?
5) How does the laboratory test protocol correlate with deicer performance in the field?
6) What is the most effective product to use and its optimal application rate to combat ice formation, under each typical road weather scenario identified by the sponsor states?

By answering the first four questions, this research will allow the transportation agency to determine whether the inclusion of inhibitors into liquid or solid deicers is cost-effective, taking into account: the acceptable deicer corrosivity, reasonable duration of protection expected of inhibitors, and other agency-specific constraints.

The deicer products to be evaluated will be decided upon by the PNS and the Technical Advisory Committee. To promote the synergy between the research related to inhibitor longevity and deicer performance, it is suggested that these two parts or phases be conducted simultaneously.

As a starting point, the deicers that will be tested fall within the following PNS Categories (specific types will be determined by the TAC):

- PNS Category 1, Corrosion Inhibited Liquid - $MgCl_2$
- PNS Category 2, Corrosion Inhibited Liquid - $CaCl_2$
- PNS Category 4, Corrosion Inhibited Solid - NaCl

2. Project Schedule and Work Plan for the First Year

Table 2-1 is a high-level schedule for the project, where the duration of each task is given in months. The schedule has been established for a three-year period, assuming a start date of October 1, 2007.

As shown in Table 2-1, the work plan for the first year includes the following tasks (see the technical details in the full proposal attached):

Task 0. Project Management
-including project kickoff meeting

Task 1. Experimental Design and Planning
- to be 90% complete by the end of first year

Task 2. Laboratory Investigation

Task 2.1. Methods to Rapidly Quantify Chloride and Inhibitor Concentrations
- to be 100% complete by June 2008

Task 2.2. Method to Rapidly Quantify Corrosivity of Deicers
- to be 100% complete by June 2008

Task 2.3. Method to Rapidly Quantify Deicer Performance
-to be 100% complete by June 2008

Task 2.4. Inhibitor Longevity under Laboratory Conditions
- to be 60% complete by the end of first year

Task 3. Field Investigation

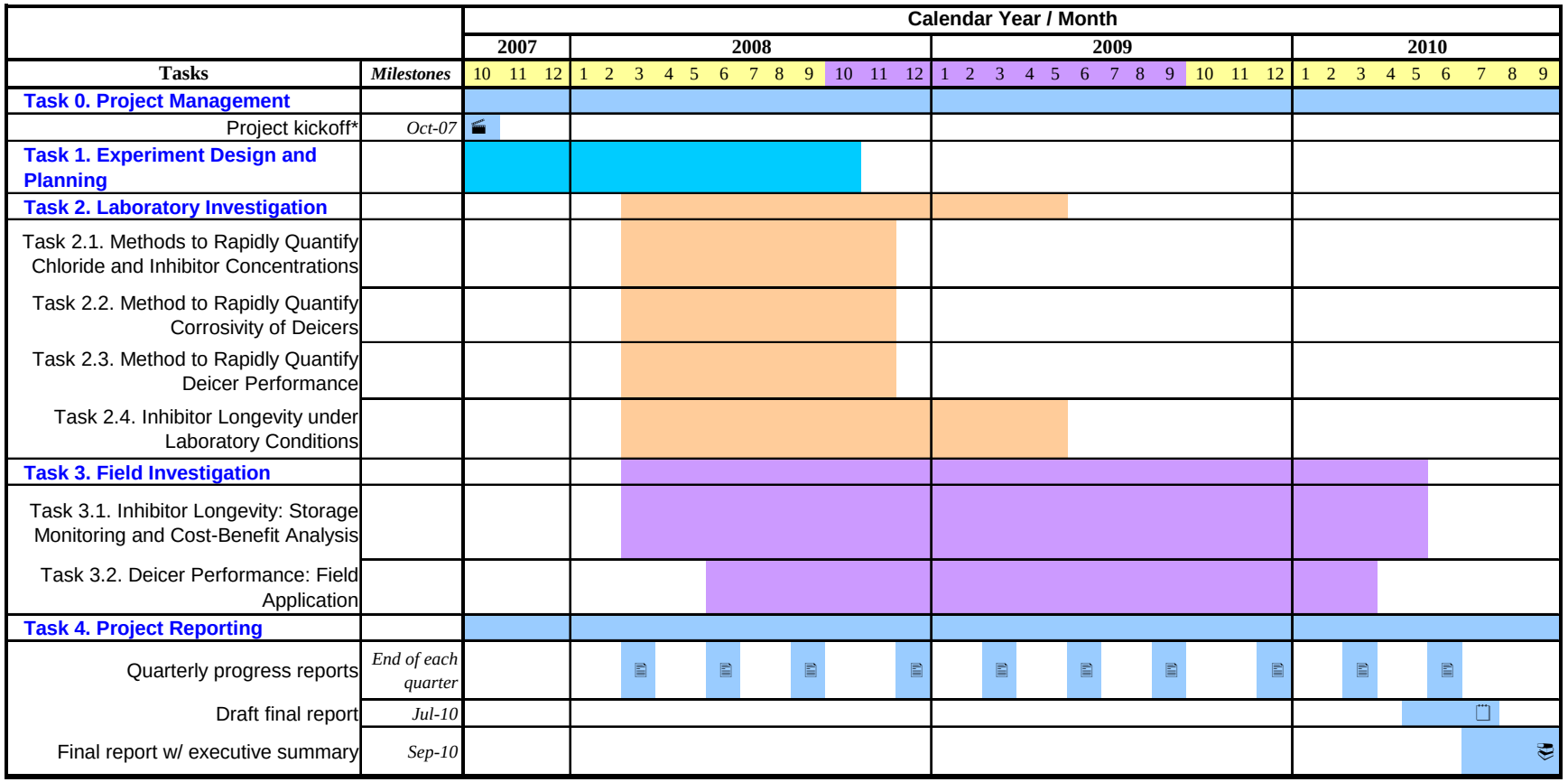
Task 3.1. Inhibitor Longevity: Storage Monitoring and Cost-Benefit Analysis

- to complete the first months of storage monitoring by the end of first year and to generate useful data. Results from the first year of inhibitor longevity testing should provide sufficient knowledge so that the Steering Committee and TAC may select the solid and liquid products of interest for further testing in Task 3.2.

Task 3.2. Deicer Performance: Field Application

Some field trials will be conducted in the winter of 2007-2008 to test the validity of methods for field application of deicers and sampling of deicer residues on pavement. Equipment to be used for application of deicers may be scaled down from a snow plow to a 4-wheeler (quad) with liquid and solid application abilities. In addition, methods to sample deicer residues from pavements (with frost, black-ice, snowy, icy conditions) will also be experimented in the winter of 2007-2008 before the full-scale testing in the following winter.

Table 2-1: Updated project timeline by month (updated 2/2008)



*UTC portion started 8/1/07 and we expect the PNS portion to start 2/1/08.

Laboratory testing in the 2007-2008 will include using the MSU Civil Engineering Department Sub-zero Research Facility. The dilution factor of the deicers and inhibitors will tested as well as the potential percent recovery of material off asphalt pavement surfaces. This testing will utilize asphalt pavement slabs made by the MDT.

Task 4. Project Reporting

As one activity under this task, the research team will provide quarterly progress reports to the TAC through the WSDOT project manager. These progress reports will cover recent activities associated with Tasks 1 through 3. The summary will describe, for each task, activities completed in the most recent three-month period, activities foreseen for the next three-month period, and the estimated percentage of work complete. The progress reports will also include a brief, executive summary-level narrative of preliminary findings.

As necessary, the progress reports will describe any issues or obstacles that have affected project progress or the direction of the research. However, the research team believes that it is better to address these issues as they arise; therefore, regular communication between the team and the TAC (described under Task 0) will be used to more quickly resolve any such issues.

The research team will submit the progress reports electronically as Microsoft Word™ documents. If the TAC members are interested, the research team may present the progress report as a Microsoft PowerPoint™ presentation in a teleconference that would be arranged by the TAC.

3. Budget and Level of Effort

The estimated budget and detailed efforts for the first year of the Pooled Fund Study are listed in Table 3-1, totaling $224,754 and 2,074 person-hours, respectively. The Transportation Pooled Fund will provide 70.8% of the funding ($159,126) and the Western Transportation Institute will provide 29.2% of the funding ($65,628) for the first federal fiscal year. The personnel will include Dr. Shi (PI), Ms. Fay (Co-PI), a Senior Field Engineer (as Liaison with the RAC), Dr. Nguyen (Electrochemist), Ms. Huang (Statistician), Ms. Akin (Coordinator with Lewistown Test-bed Project), a Civil Engineer, WTI administrative support, laboratory technician, and undergraduate students. Other items include: Travel (between Bozeman and the Lewistown Test-bed; trips to report progress and present results); Operations/Communications; Contracted Testing Services (for UV-Vis, DSC, and other chemical analysis); Lewistown Facility Usage (for the use of portable road weather sensors, test tracks, storage sites and tanks, and office space); and Corrosion Lab Testing and Other Supplies (for PNS/NACE tests, electrochemical tests, ice-melting tests, etc.). Indirect costs are charged at 42.5 percent of direct costs; this rate is the standard used by Montana State University on research contracts.

Table 3-1: Proposed first year project budget by cost category

	Role	Federal Fiscal Year 2007	Hours	Cost
Dr. Xianming Shi	PI	168	**168**	**$9,798**
Ms. Laura Fay	Co-PI	168	**168**	**$6,276**
Dan Williams	Liasion/ Advisor	100	**100**	**$4,708**
Laboratory technician	Chemist	590	**590**	**$16,471**
Dr. Tuan Anh Nguyen	Chemist	504	**504**	**$15,276**
Ms. Jiang Huang	Statistician	40	**40**	**$1,267**
Ms. Michelle Akin	Coordntr w/ Lewistown	40	**40**	**$1,349**
Mr. Eli Cuelho	PE/ Research	12	**36**	**$1,824**
Undergraduate Student	Research	400	**400**	**$4,400**
Business Manager	Support	12	**12**	**$511**
Administrative Support	Support	40	**40**	**$1,006**
Labor (hours)		**2,074**	**2,074**	
Labor ($)		**$61,822**		**$61,822**
Travel		**$2,000**		**$2,000**
Operations/Communications		**$400**		**$400**
Infrastructure start-up cost		**$80,000**		**$80,000**
Contracted Testing Services		**$3,500**		**$3,500**
Lewistown Facility Usage		**$3,000**		**$3,000**
Corrosion Lab Testing and Other Supplies		**$7,000**		**$7,000**
Indirect (42.5%)		**$67,032**		**$67,032**
Total Cost ($)		**$224,754**		**$224,754**

First Year	Transportation Pooled Fund	70.8%	**$159,126**
First Year	Western Transportation Institute	29.2%	**$65,628**